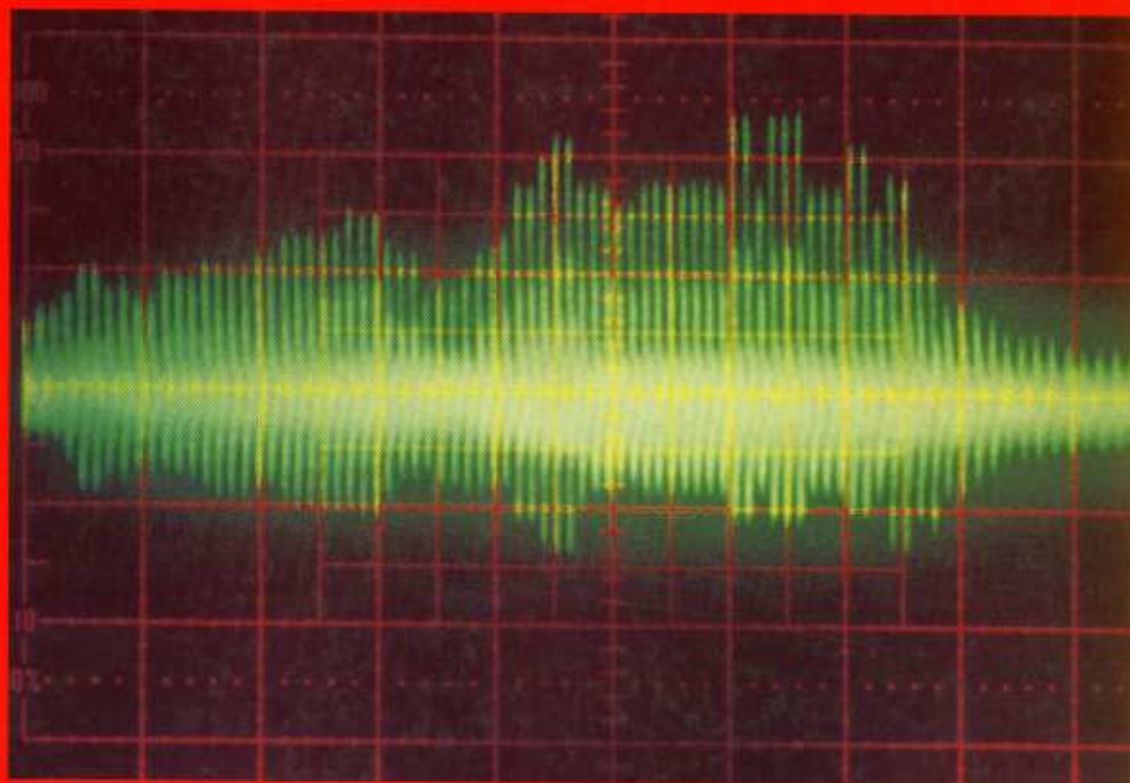




Sound and Hearing





Sound and Hearing

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How sounds are made

A sound is made because something moves. A guitar produces a note when a string is plucked. A machine makes a noise when it is working. Human beings and animals produce noises by making their mouths and throats move.

Some sounds are natural sounds. Others are artificial sounds, produced by human beings or by the things they have made. What sounds can you hear from where you are reading this book? Which of these sounds are natural sounds? Which of them are artificial sounds?

Vibrations

Sounds are made by a movement backwards and forwards, called a *vibration*. Vibrations travel through the air to our ears, and we hear them as sounds. When objects vibrate at different speeds, they make different sounds. The same object can make high or low sounds. We say that these sounds are at a different *pitch*.



This old alarm clock has a bell on top. The alarm rings when a tiny hammer hits the bell. You can feel the bell vibrate.



The world is full of many different sounds.

The pitch of a sound depends upon how fast an object vibrates. You can prove this by a simple experiment.

 1 Place a ruler on the edge of a table, and hold it firmly.  2 Pull down the end of the ruler, and let it go. Listen carefully to the pitch of the sound it makes, as it vibrates.	 3 When a shorter length of the ruler is used, it vibrates more quickly. A higher-pitched sound is made.  4 When a longer length of the ruler is used, it vibrates more slowly. A lower-pitched sound is made.
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Activities

1 Put two fingers on the front of your throat, then make a humming sound. The sound is made by your vocal cords vibrating. You can feel the vibrations with your fingers.

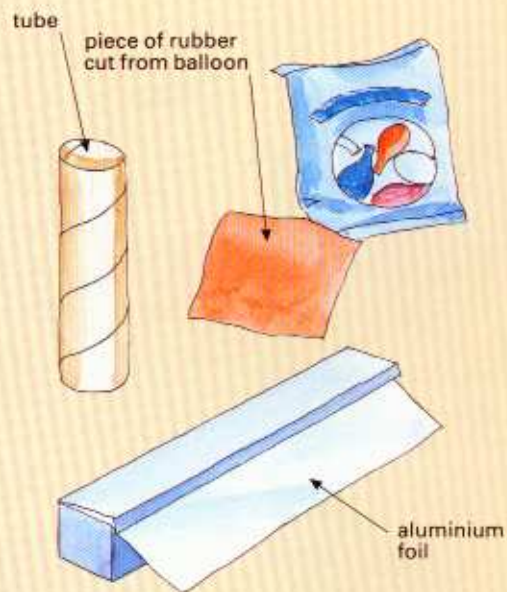
2 Ring a hand bell, then hold the edge of the bell against your hand. What do you notice? Talk about how a bell makes its sound.

3 If you hold the bell in different ways, and then ring it, does it make a different sound? Can you suggest why?

4 Tap a cymbal. Listen and watch carefully. Record what you see and hear. What happens if you tap the cymbal, and then (a) touch it gently, (b) grip it firmly?

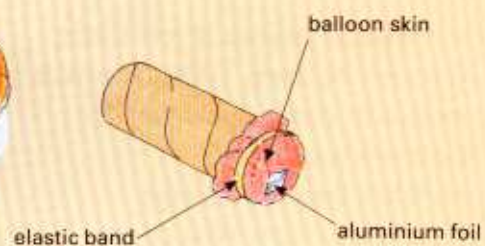
How to see the sound of your voice

- 1 Take a small tube of cardboard or plastic.
- 2 Stretch part of a balloon so that it covers one end of the tube.
- 3 Fix the piece of balloon to the tube with rubber bands or sticky tape.
- 4 Tear a small square of aluminium foil, about $\frac{1}{2}$ cm across, from a roll of kitchen foil.
- 5 Glue the foil onto the piece of balloon, near the edge of the tube.
- 6 Stand in front of a shaded bare wall, or a shaded wall on which you have hung a piece of cardboard.
- 7 Allow the sun to shine onto the foil, or put a table lamp so that it shines onto the foil. This will make a reflection on the wall or cardboard.
- 8 Speak into the end of the tube, and watch what happens.



When you speak into the tube, the sound of your voice makes the piece of balloon vibrate. The vibrations make the foil move, so its reflection moves too.

What happens when you whisper? when you shout? when you sing?



Different kinds of sound

The lowest pitches the human ear can hear are made by things that vibrate at about 20 times a second.

The number of times a sound vibrates in one second is called its *frequency*. The frequency of a sound is measured in units called *hertz*. A low note might have a frequency of 50 hertz (or 50 Hz). Hertz was the name of a German scientist, who lived in the last century.

The highest sound which a human can hear varies from one person to another. A bat's squeak has a very high frequency. Some people can hear it; others cannot. Sounds which have a frequency of over 20 000 Hz are called *ultrasonic* sounds.

Dogs can hear ultrasonic sounds. You can buy a special whistle from a pet shop. When you blow the whistle, a dog can hear it, but human beings cannot.

A sound may be loud or soft. The loudness, or volume, of a sound depends on the size of the vibrations. When we tap a drum, it produces small vibrations, and makes a soft sound. When we bang a drum, it produces large vibrations, and makes a loud sound.



A tuning fork is made so that it always vibrates at the same frequency to produce the same note.

Activities

1 Put a few peas on a drum. First, tap the drum lightly, then bang the drum. What do you notice about the movement of the peas? Can you explain why they move differently when you tap the drum and when you bang it?

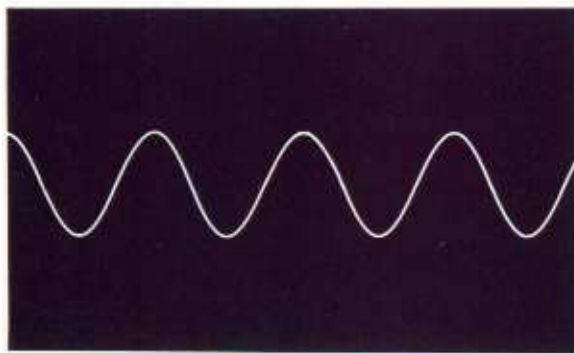
2 Tap a tuning fork on a wooden surface to make it sound. Then put the point of the fork against your ankle or the back of your hand. What do you feel?

3 Make a tuning fork sound. Then put it into a bowl of water. What happens?

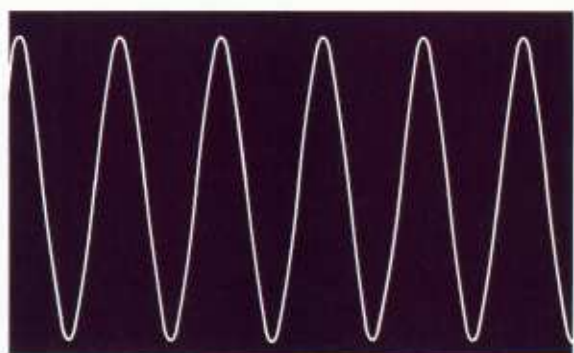
Sound waves

When a stone is thrown into water, it makes small waves or ripples. The waves spread outwards from the point where the stone enters the water. Sounds also travel in waves. They spread outwards in all directions from the object making the sound.

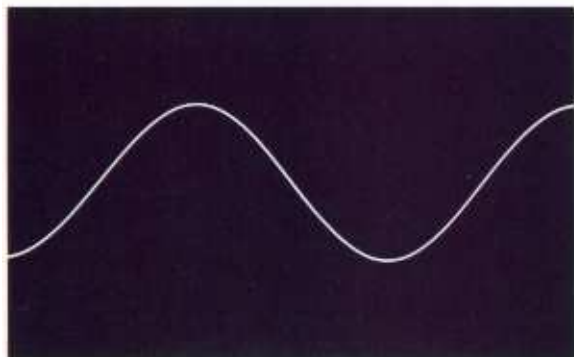
Sound waves have different patterns. We cannot see the sound waves we get from a drum, but we can see pictures of them on a machine called an *oscilloscope*. The oscilloscope has a screen which looks like a television screen. Here are pictures of some different sounds.



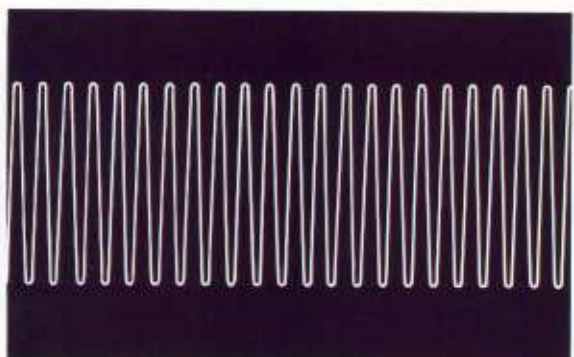
A soft sound, made by tapping a drum.



A loud sound, made by banging a drum.



A low note: the crests of the sound waves are far apart.

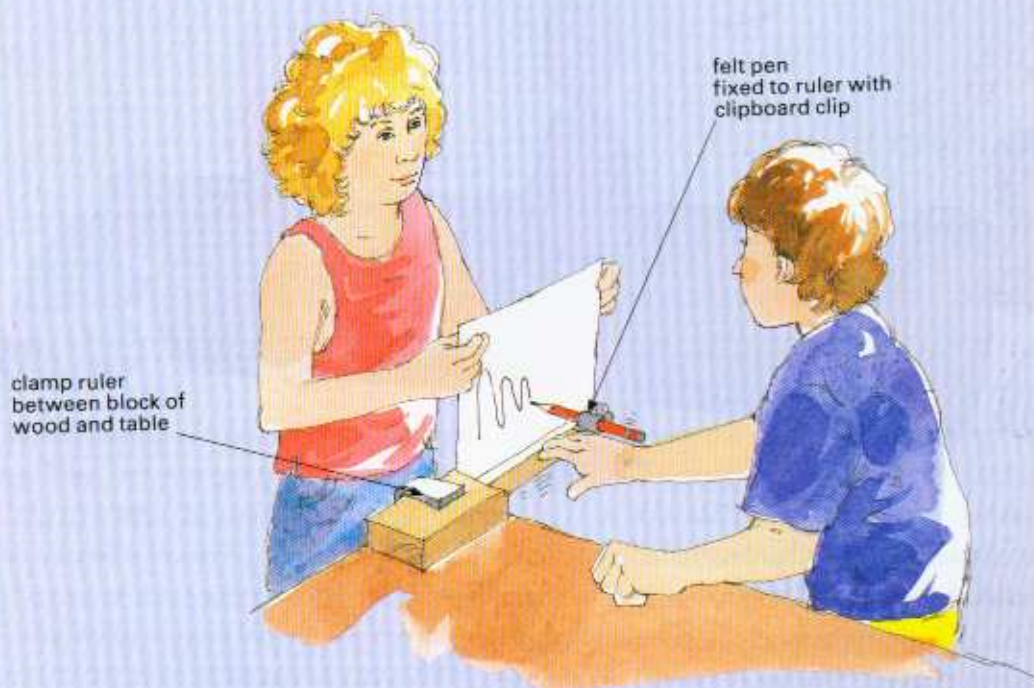


A high note: the crests of the sound waves are close together.

How to make a graph of sound waves

- 1 Take a metre ruler, and fix it to a table by using a clamp and a block of wood.
- 2 Use a bulldog clip to fix a felt tip pen onto the end of the ruler, so that it is pointing sideways, at right angles to the ruler.
- 3 Ask a partner to hold a piece of white card, so that the pen is just touching the card.
- 4 When you make the ruler vibrate, tell your partner that you want the card to be moved slowly and carefully towards the table.
- 5 Press down hard on the ruler, then let it go, so that it vibrates and makes a humming sound.
- 6 As your partner moves the card towards the table, the pen will draw a graph of the sound waves made by the ruler.
- 7 Repeat the experiment, using different lengths of the ruler. What do you notice about the graph (a) when the ruler is longer, (b) when the ruler is shorter?

Note: For this to work, you must make sure that you always move the card at the same speed.



How sound waves travel

Sound waves can travel only when there is a substance to carry the vibrations. They can travel faster through some liquid and solid things than through air. It depends on how easily the substance vibrates.

Sounds can travel a long way. The North American Indians used to put their ears to the ground, to listen for the sound of their enemies. They could hear horses' hoofbeats from several kilometres away.

The picture shows a man scratching a tree trunk with a nail. The man at the other end of the trunk can hear the scratching sound, because his ear is against the trunk. The man standing in the middle is closer to the sound, but he cannot hear it, unless he puts his ear against the trunk.



A substance through which sound can travel is called a *sound medium*. Air is usually the medium through which sounds travel. If there is no air, sounds cannot travel. There is no air in space, so when we send sounds across space, we have to change the vibrations into electrical signals.

This experiment shows that sound cannot travel through an empty space, or *vacuum*, containing no air.

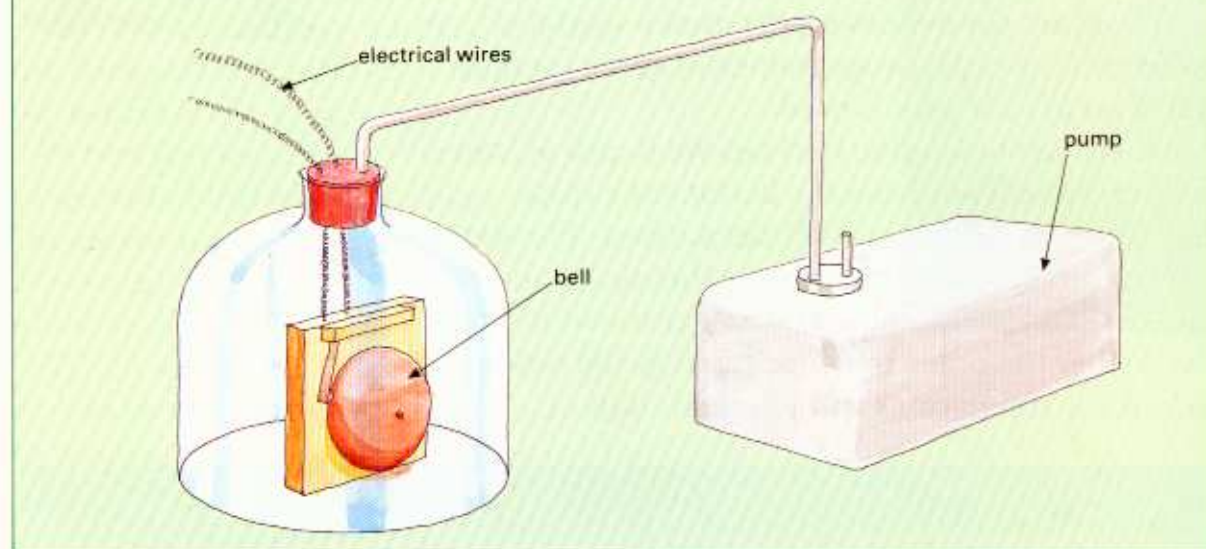
1 An electric bell, connected to a battery, is put in a jar. An air pump is fitted to the jar, which is then sealed tight.

2 The electricity is switched on, and the bell starts to ring loudly.

3 The air pump is switched on.

As the air is pumped out, the ringing of the bell becomes fainter.

4 As the jar is filled with air again, the ringing becomes louder and clearer.



Activities

1 Tap on the top of a table with a pencil, and listen. Then, put your ear against the table, and tap on it with the pencil again.

Which sound is louder? Can you say why?

2 Tie two or three spoons to the end of a piece of string about a metre long. Swing the spoons gently so that they strike against each other.

Listen to the sound they make. Then tie the end of the string round a finger, and put the finger in your ear. Swing the string so that the spoons knock together. Listen to the sound.

How is it different? Can you say why?

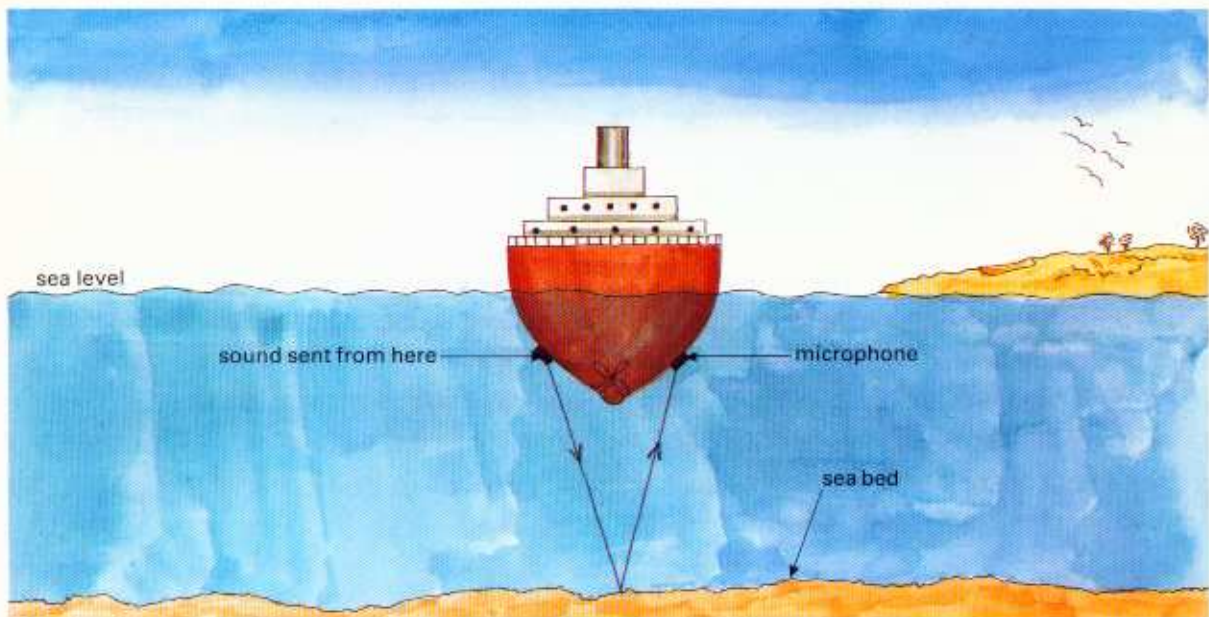
Echoes

Sound waves bounce off hard surfaces, just as light rays are reflected by a mirror. When a loud sound bounces off a hard surface, in an enclosed space, it makes an echo.

You can produce an echo by standing near the wall of a large building, and shouting. You can hear the echo of your voice. How long the echo takes to reach you depends on how near you are to the wall.

Echoes are sometimes used to make special effects on records or radio programmes. A special room, called an *echo chamber*, is used.

Echoes can be used to find out the depth of water. A sound is sent out from the bottom of a ship. The sound waves bounce off the sea bed. The depth can be worked out from the time that the sound takes to travel back to the ship. The longer the sound takes, the deeper the water is. Echoes can also be used to look for submarines and wrecked ships.



The speed of sound

Sound travels through air at 1200 kph.

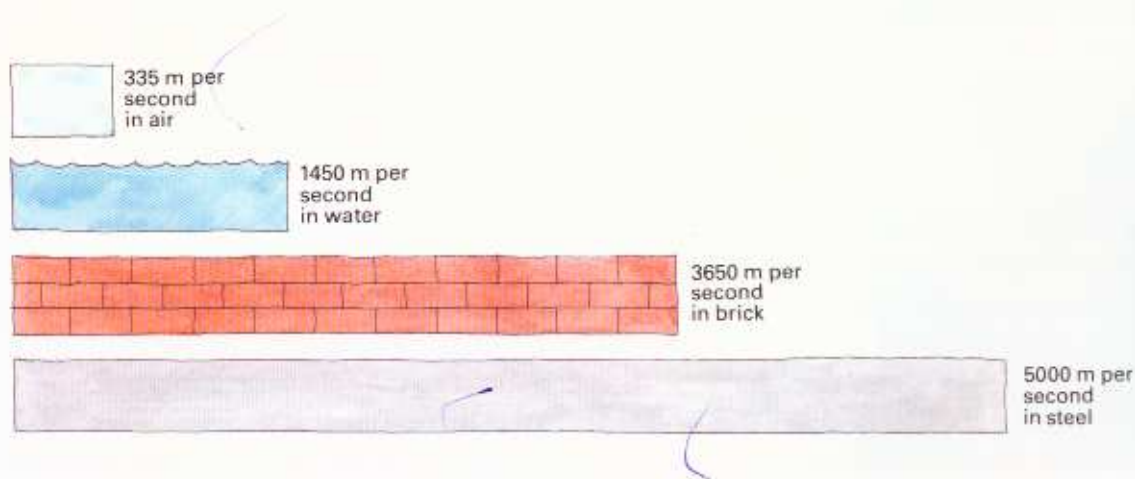
This is fast, but it is much slower than the speed of light. It takes three seconds for sound to travel one kilometre. In three seconds, light travels nearly a million kilometres.

This means that you see things happening before you hear them. You always see the flash of lightning before you hear the crack of thunder. When someone fires a gun in the distance, you will see the flash and the puff of smoke before you hear the sound of the shot.

When you see a flash of lightning, start counting in seconds. Stop when you hear the thunder. Divide the number of seconds by 3. This tells you how many kilometres you are from the centre of the storm.

When you hear a plane in the sky, it is not always easy to spot it. The sound waves may take a minute to reach you. By the time you look up, the plane may have travelled another 10 or 15 kilometres.

Sounds travel at different speeds through different substances.



The sound barrier

Some jet aircraft can fly through the air at speeds of over 1200 kph. A plane like Concorde can fly at twice the speed of sound.

When a plane flies through the air faster than the speed of sound, we say that it 'breaks the sound barrier'. The plane is going so fast that the particles of air cannot move out of its way fast enough. It has to cut through the air, and this makes a shock wave.

The shock wave is a very powerful sound wave, called a *sonic bang*. It follows along behind the plane, and the vibrations are powerful enough to break windows.



Aircraft that go faster than the speed of sound are called *supersonic*. A supersonic aircraft has a pointed nose to help it cut through the air.

Activities

- 1 What is a sound medium?
 - 2 Which of these is *not* a sound medium: the ground, air, a vacuum, a wooden plank? Why is it not a sound medium?
 - 3 How fast does sound travel through air?
 - 4 Does sound travel faster or slower than light?
 - 5 In a storm, would you hear thunder before you saw lightning? Why?
 - 6 What does the word 'supersonic' mean?
 - 7 What is a sonic bang?
 - 8 Draw a picture of a supersonic aircraft. What is special about its shape?
-

Musical instruments

Sounds can be divided into musical sounds and noises. We hear music when an object makes regular vibrations at regular intervals.

We hear a noise when an object makes irregular vibrations at irregular intervals.

There are three groups of musical instruments.

Percussion instruments

Instruments such as bells, gongs, cymbals, and drums are known as percussion instruments. The musical sound is made by hitting the surface of the instrument.

Wind instruments

You can make a musical note by blowing across the top of a bottle. The sound from woodwind and brass instruments is made by blowing air into a tube or pipe. The air inside the tube or pipe vibrates regularly, and makes a musical sound.

The sound of the note depends on the length of the pipe. Short pipes produce high notes. Long pipes produce low notes. Large organs sometimes have pipes 20 metres long, to make low notes.

You can change the length of the pipe on woodwind and brass instruments by opening or closing holes along the pipe. On a trombone, the length is changed by moving a slide.



A milk bottle organ

Take an empty milk bottle, and blow across the top. This makes the air in the bottle vibrate. You will hear a low-pitched note.

Now put about 3 cm of water in the bottle, and blow across the top again. Listen to the note it makes. There is less air in the bottle, so the note is higher than the note made by the empty bottle.

Add another 3 cm of water, and blow across the top again. The more water you add, the higher the note you make when you blow.

Get a number of milk bottles. Put different amounts of water in each of them, so that when you blow across the top, each bottle produces a different note. See if you can play a simple tune on your bottle organ.



Milk bottle bells

Take a stick and tap it against each of the bottles in turn. Listen to the note each bottle makes. How are the notes different from the notes you make when you blow across the top of the bottles? Can you explain why?

When you tap a bottle, the water in it vibrates. A bottle with a lot of water in it gives a low note. A bottle with a small amount of water in it gives a high note. See if you can play a simple tune by tapping on the bottles.



Stringed instruments

Stringed instruments consist of a number of strings stretched over a board or box. This is known as the *sounding board* or *sound box*. The instruments are played by rubbing or plucking the strings.

The strings vibrate, and make sounds. The sounds bounce against the board or inside the box. This makes the note louder, and adds to the tone.

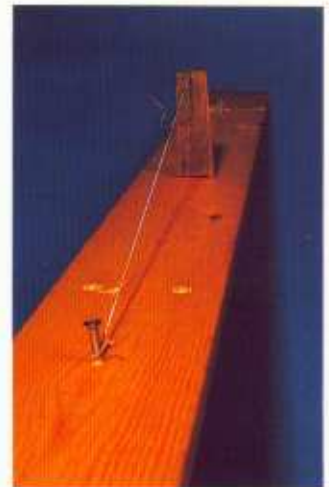
The sound of a note depends on three things: how long the string is, how tight it is, and how thick it is.

1 Shorter strings make higher notes. The string in picture A will give a higher note than that in picture B.



2 The strings are fixed to pegs. By turning the peg, you can tighten or loosen the string. When a string is made tighter, it makes a higher note.

3 When two strings are the same length and the same tension, a thick string makes a lower sound than a thin one.



Activities

Make a one-stringed musical instrument, using a board, a length of guitar nylon, and two screws.

1 Pluck the string. What do you see and hear?

2 Pluck the string again, and at once touch it with your finger. What happens?

3 Use a piece of wood to make a bridge.

Pluck the string again. What do you see and hear?

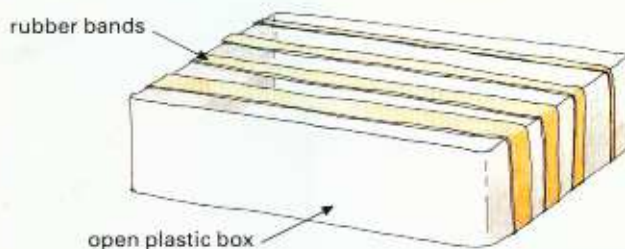
4 What happens if you put the bridge in different positions? Record what you see and hear when the bridge is in these positions.

Can you explain why the instrument makes different notes when you move the bridge?

Investigating rubber bands

Experiment 1

- 1 Stretch a rubber band round a large empty jar.
- 2 Put a pencil under the rubber band, so that it is across the centre of the top of the jar.
- 3 Pluck the two sections of rubber band on each side of the pencil, and listen to the sounds.
- 4 Move the pencil slightly, so that it is nearer to one side of the jar than the other. Pluck the two sections again. What do you notice?
- 5 Continue the experiment by moving the pencil closer and closer to the edge of the jar. Tell each other what you discover about the sounds made by the rubber sections when they are different lengths.



Experiment 2

Take some rubber bands of the same length but different widths. Stretch them round an empty plastic box. Pluck each band in turn. What is the difference between the sounds made by thin bands and thick bands?

Experiment 3

Stretch a rubber band round an empty plastic box. Pluck it, and listen to the sound. Pull the band tighter, and pluck it again. What happens to the sound (a) when you tighten the band? (b) when you loosen it?

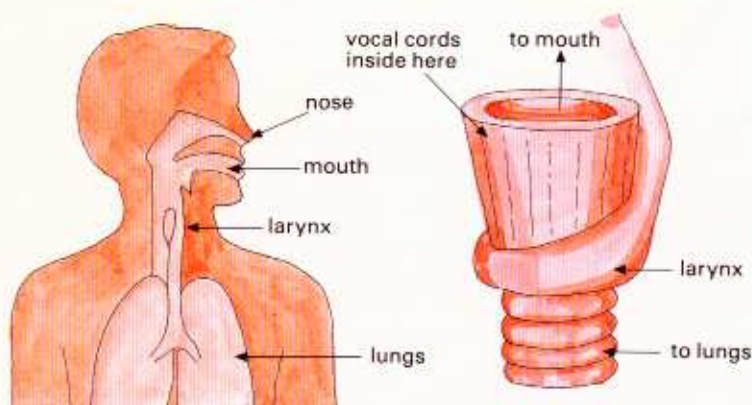


Music with coffee jars and rubber bands

Collect some empty coffee jars, and stretch rubber bands of different sizes around them, so that they make different notes when you pluck them. In a group, each take a jar, and form a band. Choose someone to be the conductor. It is their job to point to the person whose turn it is to play the next note. Practise playing a simple tune.

The human voice

The human voice comes from an area in the throat called the *larynx*. The larynx lies behind the lump at the front of the throat, called the 'Adam's apple'. Inside the larynx are the vocal cords.



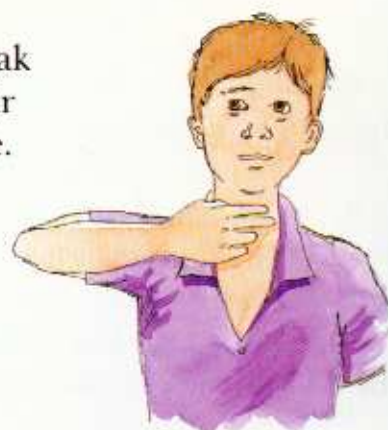
The vocal cords

The vocal cords are two folds of muscular tissue on opposite sides of the larynx. When we want to speak or sing, we must make our vocal cords vibrate. The air going past the vocal cords helps to make them vibrate. The sound produced is then shaped by our mouths and noses to form the sounds we hear.

The pitch of a sound depends mainly on the rate of vibration of the vocal cords. The faster our vocal cords vibrate, the higher the pitch of the sound that we produce.

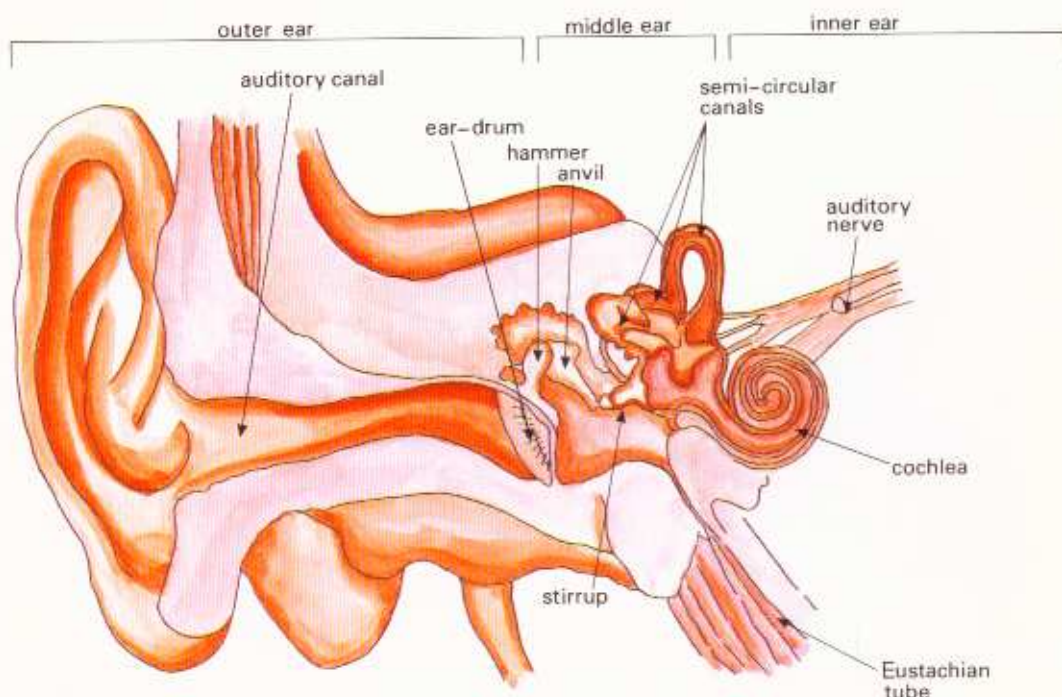
In a man, the vocal cords are usually thicker than in a woman. So a man's vocal cords vibrate more slowly, and produce a deeper sound.

The size and shape of the vocal cords, mouth, and nose vary from person to person. That is why your voice is different from everybody else's voice.



Put two fingers on your throat. Hum a high note, then a low note. What do you feel?

How our ears work



Without our ears, we would not be able to hear the sounds around us. Our ears pick up sound waves, and change them into nerve signals. These signals are sent to the brain along a main nerve called the *auditory nerve*. The brain recognises the signals, and we hear the sounds which our ears picked up.

The human ear has three main parts: the outer ear, the middle ear, and the inner ear.

The outer ear

The outer ear is the part that can be seen. Its shape enables it to collect sound waves. These sounds are then passed to the middle ear, down a passage called the *auditory canal*.



The middle ear

The middle ear is separated from the outer ear by a thin piece of tissue known as the *ear-drum*. When sound waves reach the ear-drum, it vibrates.

The vibrations are picked up by three small bones. They are the smallest bones in our bodies. They are called the *hammer*, the *anvil* and the *stirrup*, because of their shape. These bones help to make the vibrations bigger, and pass them on to the inner ear.

The middle ear is joined to the back of the nose by a passage known as the *Eustachian tube*. This tube lets air from the nose reach the middle ear. Because air from the outside is always pressing on the ear-drum, there must be air on the inside as well. Otherwise, the ear-drum would be pushed inwards, and would not be able to vibrate.

The inner ear

The inner ear has two parts. One of them is shaped like a snail's shell, and is called the *cochlea*. The cochlea is filled with a liquid. The vibrations from the middle ear pass into the cochlea, where they are changed into signals. The signals are sent along the auditory nerve to the brain.

The other part of the inner ear gives us our sense of balance. It consists of three semi-circular canals filled with liquid.

Doctors use an instrument called an *otoscope* to look inside your ears, to see if they are damaged or have an infection.



Very loud noises can damage your ears. If you play your personal stereo too loud, you can cause permanent damage to your ears.

How sharp is your hearing?

How far away do you think you will be able to hear the sound of a drawing pin being dropped? Carry out a test to find out how sharp each person's hearing is. Record your findings on a chart.

Try dropping the drawing pin on different surfaces. What difference does it make if you drop it into a tin, on a carpet, on a wooden floor, or on concrete?

WARNING When you study hearing, *never* put hard objects in your ears. Your eardrums are easily damaged.

Are two ears better than one?

Carry out these tests with a partner.

- 1 Put a few dried peas or some paper clips in a small box, so that you can make a soft sound by shaking it. Put on a blindfold, and put cotton wool in one ear. Get your partner to shake the box in different places around your head – in front of you, behind you, to your left, to your right, and above your head. Can you tell where the sound is coming from? Where is it easiest to tell and hardest to tell? Record your results. Try the same test with your other ear blocked, and then with both ears open. Compare your findings.
- 2 Put on a blindfold, and put cotton wool in one ear. Get your partner to hide an alarm clock with a loud tick somewhere in the room. How easily can you find it? Try the same test with the other ear blocked, then with both ears open.



Some animals, such as rabbits, have large ears. Why do large ears help these animals to hear more than they would with small ears? How do other animals hear? For example, how do birds, fish, and snakes hear?

Speaking tubes and telephones

There are several ways of making voices carry further than is naturally possible.



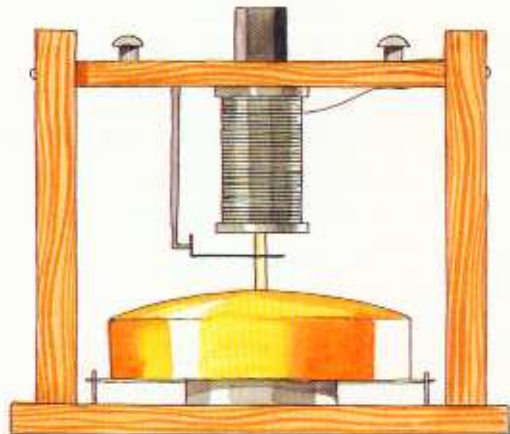
By cupping your hands round your mouth, and shouting. Your hands stop the sound waves spreading, and your voice carries further.



By using a megaphone or a speaking trumpet. This also stops the sound from spreading.



By using a speaking tube. Ships sometimes have a speaking tube from the bridge to the engine-room.

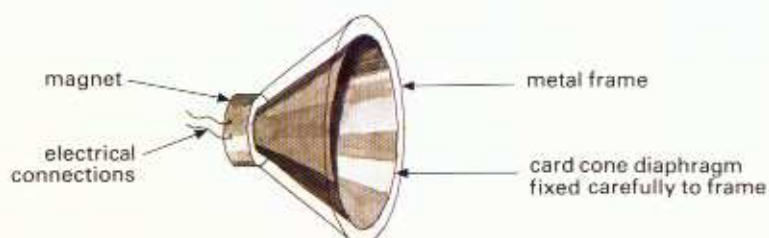


By using a telephone. The first telephone was invented by Alexander Graham Bell in 1876.

How a telephone works

A telephone uses electricity to carry sounds. The sounds are changed into electrical signals. These signals can be sent along wires, right round the world.

The mouthpiece



Sounds can be changed into electrical signals by a microphone. There are several different types of microphone. The mouthpiece of a telephone contains a carbon microphone.

Inside the microphone is a small container full of grains of carbon. The lid of the container is a thin piece of metal. When sound waves reach the lid, it vibrates. The lid presses down on the carbon grains. When the sound is loud, the grains are packed tightly together. Softer sounds pack the grains together less tightly.

An electric current is passed through the grains of carbon. The amount of current passing through depends on how tightly the grains are packed. When the grains are close together, more current passes through. The electric current reproduces the pattern of the sound waves. The signals travel along a wire to another telephone, where the earpiece changes them back into sounds.

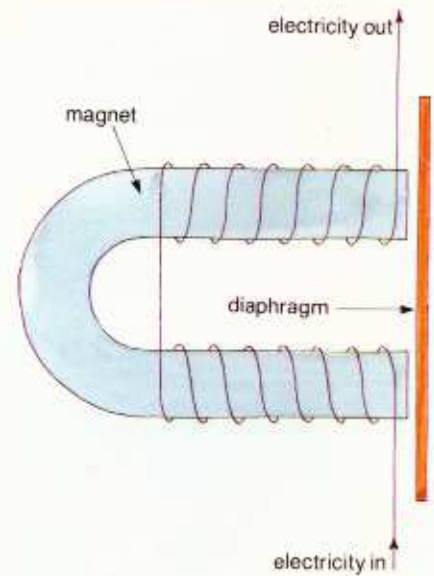


The ear piece

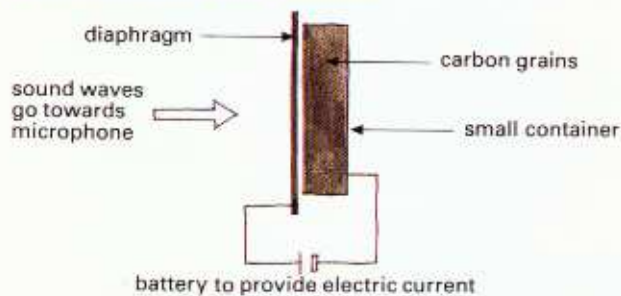
In the telephone earpiece, the electrical signals are changed back into vibrations. The wire which carries the electricity is twisted round a magnet. There is a thin metal sheet at the end of the magnet. This is called a *diaphragm*.

When the electricity passes through the wire, it makes the magnet stronger. The diaphragm is pulled towards the magnet.

The electrical signals passing through the wire represent the speaker's voice. The strength of the signals controls how far the magnet pulls the diaphragm towards it. The diaphragm vibrates, and produces sound waves. The speaker's voice is reproduced.



Loudspeakers and amplifiers



Loudspeakers work in a similar way, and change electrical signals back into sound. A loudspeaker in a record player has a much bigger diaphragm than an earpiece in a telephone. It has a metal centre, with a cone of card around it. It vibrates much more, and can produce louder sounds.

Often the current from a microphone is not strong enough to make a loudspeaker work. In many sound systems, weak currents are changed into strong ones using a piece of equipment called an *amplifier*.

How to make a string telephone

Take a long piece of string and two empty yoghurt pots. Make a small hole in the bottom of each pot. Thread the string through the holes, and tie a knot inside each pot.

Give one pot to a friend, and stand so that you are too far apart to be able to hear each other talking. Make sure the string between you is tight. When you talk into the open end of your pot, the vibrations from your voice travel along the string. If you then put the pot to your ear, you will be able to hear your friend's reply.



Try some experiments with your string telephone.

- 1 What happens if you vary the length of the string?
- 2 What happens if the string is not tight?

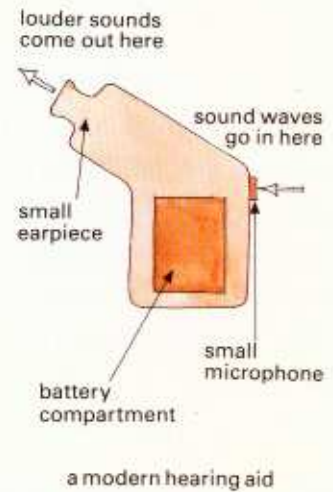
- 3 What happens if you put some knots in the string?
- 4 Can you think of a way you could make it work round the corner of a building?

Hearing aids

Around two million people in Britain cannot hear perfectly. Some are born deaf; others become deaf as a result of accidents or illness. Many people develop hearing problems as they grow old.

People who had bad hearing used to be given ear trumpets. Today, they are often given hearing aids. Hearing aids make a sound much louder, when it arrives at a person's ear-drum. They are worked by a battery. The aid has a microphone to pick up sound waves, and turn them into electrical signals. These tiny signals are made bigger in an amplifier. They then work a small earpiece or receiver.

It is possible to buy hearing aids so small that they fit right inside the ear.



Make your own ear trumpet, and carry out an experiment to see if it improves your hearing.

- 1 Measure how far you can stand from a clock, and still hear it ticking.
- 2 Take a piece of thin card. Cut it into a cone shape, and stick it together to make an ear trumpet.
- 3 Put the ear trumpet to your ear. Measure how far you can stand from the clock and still hear it. What difference does the ear trumpet make?
- 4 Why do you think an ear trumpet works?



Recording sound

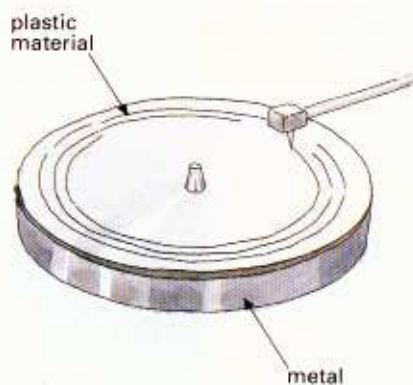
Sounds can be stored so that we can listen to them again. This is known as *recording*. The first machine for recording and reproducing sound was invented by Thomas Edison in 1877.

Recordings can be made in several ways. The sound vibrations can be stored in the form of a spiral groove, which is cut in the surface of a plastic disc, or record. They can also be stored on a magnetic tape, by turning the vibrations into electrical signals. The signals then make changes in the surface coating of the tape. This is known as *magnetic recording*, and is the method used in tape recorders.

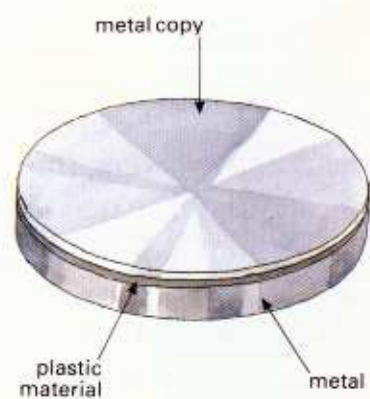
How a record is made



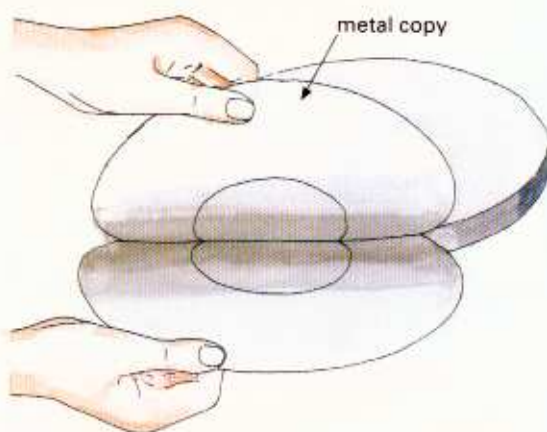
1 The musicians perform in a studio. The sounds which they make are recorded onto a tape recorder by engineers.



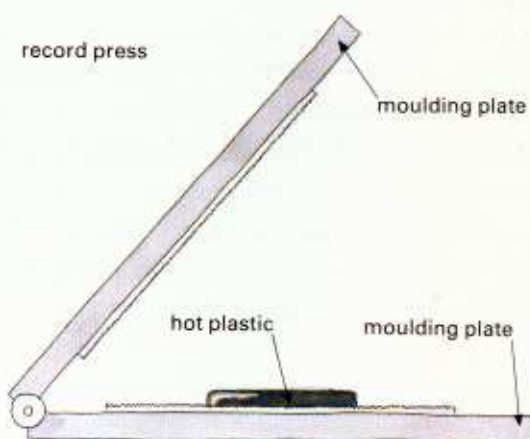
2 The recorded signals make a cutter vibrate. The cutter makes a groove in a metal disc which has been coated with a plastic material. The signals alter the size and shape of the groove.



3 The disc is called the *master disc*. The recorded side of this disc is treated with chemicals in a special bath. As a result, a metal copy is made of the groove on the master disc.



4 The metal copy is pulled off the master disc. This copy is then used to make the main moulding plates. These plates will stamp the groove onto the records.



5 The moulding plates are put in a record press. A piece of hot plastic is placed between them, and pressed into shape, to make the record that we buy.

Record players

We can reproduce the sounds on a record by placing it on the turntable of a record player. When we make the turntable spin round, a pointed needle, called a *stylus*, moves along the groove and vibrates.

In early record players, the sound was made by the vibrations of the needle. A large horn was used, to make the sound as loud as possible.

In modern record players, the stylus vibrations are changed into electrical signals by a cartridge fixed to the pick-up arm. The signals are made stronger by an amplifier. They then go through a loudspeaker, and are changed back into sounds.



Looking at records

- 1 Stick a pin or a needle into the bottom of a paper cup, and use Plasticine to hold it in place.
- 2 Put an old record on a record player.
- 3 Ask an adult to switch on the record player, so that the record goes round.
- 4 Hold the cup so that the pin is touching the record. Watch and listen to what happens.
- 5 Switch off the record player.
- 6 Look at the record through a magnifying glass. What do you notice about the grooves?

Imagine you meet someone who has never seen a record or record player. Take it in turns to explain (a) what a record is, (b) how a record is made, and (c) how a record player works.



Noise pollution

Noise can harm people in two ways. Noises going on for a long time can make people tired and irritable. Loud noises can damage our ears, and even cause deafness. People who work in very noisy factories have to wear ear muffs.

It is possible to reduce noise by covering walls with soft materials, such as felt or cork. They soak up the sound instead of reflecting it. This is known as *soundproofing* a wall.

The loudness of sounds is measured in units called *decibels*. Sounds greater than 100 decibels can cause damage to our ears. This noise level is reached in some factories and building sites, as well as in some discos!

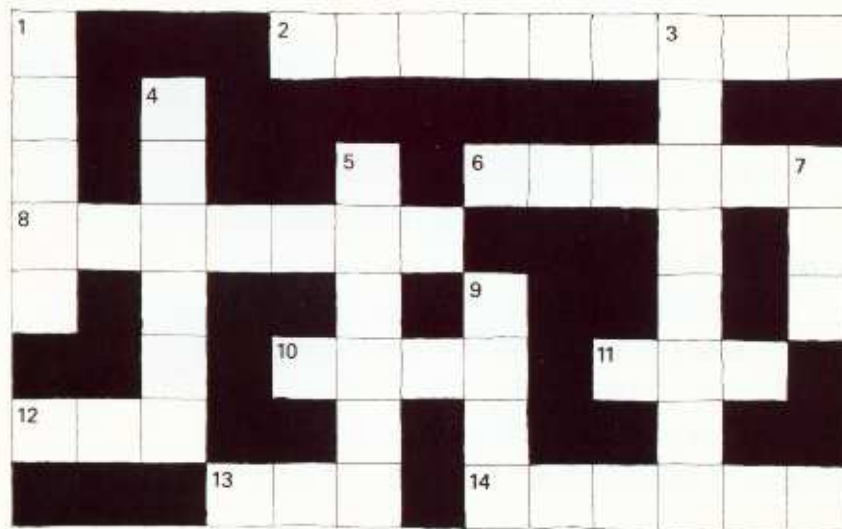


Activities

- 1 Which would be quieter: a room without furniture, or the same room fitted with carpets and curtains? Why?
- 2 When you go to a pop concert, it is a good idea to put some cotton wool in your ears. Why?
- 3 Carry out an experiment to find out which materials are good at stopping sound.

Put a clock with a loud tick in a cardboard box. Pack some newspapers round the clock, covering it completely. Can you still hear the clock? How loud is it? Try packing other materials round the clock, such as pieces of plastic, cloth, cork, cotton wool, or foam rubber. Which material is best at stopping sound?

Crossword



Clues across

- 2 Thin sheet which vibrates to make sounds (9)
 6 Section of ear containing three small bones (6)
 8 Part of the ear shaped like a snail's shell (7)
 10 The stirrup is one of the smallest _____s in the body (4)
 11 A slow vibration produces a note like this (3)
 12 The part of a record player which houses the stylus and cartridge (3)
 13 Partly deaf people need a hearing _____ (3)
 14 Area of the throat where your voice comes from (6)

Clues down

- 1 The way we describe a sound to be high or low (5)
 3 This nerve takes signals from the ear to the brain (8)
 4 Sounds will not travel through this at all (6)
 5 A disc which contains stored sound (6)
 7 The organ in our body that hears sounds (3)
 9 He invented the first telephone (4)

Glossary

amplifier (p. 23) an instrument which makes electrical signals stronger

cochlea (p. 19) a spiral tube inside the inner ear, which contains the nerve-endings needed for hearing

decibel (p. 29) the unit which measures the loudness of a sound

diaphragm (p. 23) a thin plate or membrane, which can be made to vibrate, to produce sound waves

frequency (p. 5) the number of times an object vibrates within a given period (usually, in a second)

hertz (p. 5) the unit which measures the frequency of a sound

larynx (p. 17) a part of the throat just above the windpipe, where the vocal cords are

pitch (p. 2) that feature of a sound which we judge on a scale from low to high

oscilloscope (p. 6) a machine which shows electrical movements, such as sound vibrations, as wavy lines on a screen

sonic bang or **sonic boom** (p. 12) an explosive sound made by the shock wave from an aircraft beginning to go faster than the speed of sound

sound medium (p. 8) any substance through which sound can travel

supersonic (p. 12) faster than the speed of sound

vibration (p. 2) a slight continuous movement backwards and forwards, which produces sound

vocal cords (p. 17) two folds of muscular tissue on either side of the larynx, which are helped to vibrate by the passage of air, to produce sound

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